

BENCHMARKS

VOLUME 6 NUMBER 9

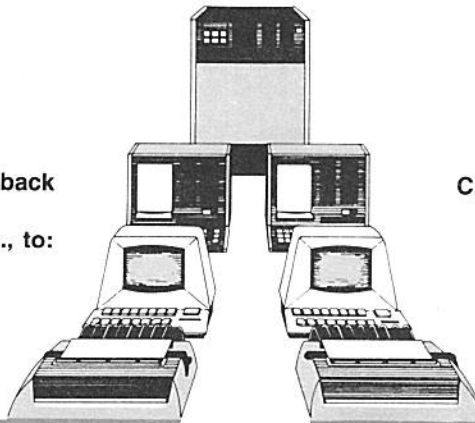
NORTH TEXAS STATE UNIVERSITY

OCTOBER 1985

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BENCHMARKS Reader/User feedback is encouraged.
Send all letters, suggestions, etc., to:
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SERVICES AVAILABLE TO USERS OF THE NTSU COMPUTING FACILITIES

The NTSU Computing Center is located in the Information Sciences Bldg., Room 119. Telephone: (817) 565-2324. HELP DESK phone: 565-4050.

BENCHMARKS QUESTIONS/CONTRIBUTIONS, ETC.
- Claudia Lynch

INFORMATION & ID CODES; DISK SPACE PROBLEMS - Carolyn Goodman

PRE-RESEARCH COUNSELING; STATISTICAL/RESEARCH SUPPORT - George Morrow, Scott Barber, Claudia Lynch, Tim King, Panu Sittiwong

STUDENT PROGRAMMING PROBLEMS - CSCI Dept., GAB Room 542A; BCIS Dept., BA Room 152

JCL PROBLEMS; PASSWORD & OPERATING SYSTEM PROBLEMS; COMMUNICATION/TERMINAL PROBLEMS - Help Desk

DATA ENTRY & KEYPUNCH; TEST SCORING & ANALYSIS - Betty Grise

ADMINISTRATIVE APPLICATIONS - Coy Hoggard

PRINTOUT RETRIEVAL - RJE Operators

DIALING UP NTSU COMPUTERS OVER THE TELEPHONE

Phone numbers for the Local Area Network (LAN) are:

300/1200 BAUD: (817) 565 - 3300, 3499

300 BAUD: D/FW METRO 429 - 6006

The numbers that will accept either 300 or 1200 baud communications have an autobaud feature that requires the user to hit the 'RETURN' key repeatedly until the receiving modem can determine the appropriate baud rate. The METRO telephone number is for 300 baud communications only. After a communications link has been successfully established, the user will receive the # prompt. At this point, it will be necessary to issue the appropriate CALL command to connect with a computer.

CALL 8040 will connect with the
8050 NAS/8043 (for MUSIC access)
8060

CALL 3270 will connect with the
3280 NAS/8043 through the 3270 protocol converter

CALL A780 will connect with VAX-A

CALL B780 will connect with VAX-B

CALL 2000 will connect with the HP-2000

NTSU CABLE SYSTEM SCHEDULE

The current configuration of the NTSU cable system is as follows:

Channel 8 — Tager microwave channel. Carries broadcasts to and from NTSU to other links in the Tager network.

Channel 10 — NTSU Computer System Status Monitor (SSM). Displays the current status of the NAS, VAX and HP computer systems supported by the Computing Center.

Channel 9 — NT Daily. Broadcast originates from the NTSU Journalism Department.

Channel 12 — Cox Cable. Currently broadcasts Cable News Network (CNN), unless a special program is requested.

Special broadcasts to and from classrooms, etcetera can be arranged by contacting the Media Library (565-2484).

HOURS FOR NTSU COMPUTER ACCESS AREAS**FALL SEMESTER*:**

<u>Days</u>	<u>Times</u>	<u>Location</u>
Sunday	2-10 p.m. Noon-Midnight 2-11 p.m.	ISB 110 Terminal Area Computing Center RJE GAB 550C
Saturday, Sunday	Noon-11:45 p.m.	College of Business
Monday	7:00 a.m.-Midnight	Computing Center RJE
Tuesday-Saturday	7:00 a.m.-Open 24 hrs/day	Computing Center RJE
Monday-Thursday	7:30 a.m.-10 p.m. 8:15 a.m.-11:45 p.m. 8 a.m.-Midnight	ISB 110 Terminal Area College of Business GAB 550C
Friday	7:30 a.m.-9 p.m. 8:15 a.m.-7:45 p.m. 8 a.m.-8 p.m.	ISB 110 Terminal Area College of Business GAB 550C
Saturday	10 a.m.-8 p.m. 9 a.m.-6 p.m. CLOSE Midnight	GAB 550C ISB 110 Terminal Area Computing Center RJE

*EXCEPTIONS for GAB 550C: 11/27 12/20 - 8 a.m.-5 p.m.; 12/16-19 - 8 a.m.-10 p.m.; 11/29 - 10 a.m.-6 p.m.; 11/28,30 12/21 - CLOSED

 *
 * NEW POLICIES,
 * PROCEDURES,
 * AND OTHER
 * IMPORTANT
 * STUFF
 *

Computing Center Fall Short Courses, Round Two

The Computing Center is offering its second series of short courses this semester. Please pre-register to attend. Only 20 people will be admitted per section. Courses marked with an * require knowledge of the MUSIC Context Editor. It should be noted that a new version of MUSIC, MUSIC/SP, is now in use. It is somewhat different than the previous version. THE COMPUTING CENTER RESERVES THE RIGHT TO CANCEL COURSES WITH LESS THAN 5 PEOPLE SIGNED UP.

1. Three separate 2-hour introductory sessions on the MUSIC/SP interactive operating system, using the 3270 Protocol Converter to do FULL-SCREEN EDITING on MUSIC/SP. To be held in Room 110 of the Science Library (ISB).
 Monday, November 4 : 8:30-10:30 a.m. Instructor: Panu Sittiwong
 Tuesday, November 5 : 6 - 8 p.m. Instructor: Tim King
 Wednesday, November 6 : 8:30-10:30 a.m. Instructor: Janice Green
2. Advanced Statistical Packages (File manipulation etc. in SAS & SPSS-X). To be held in GAB 309.
 Monday, November 4 : 9-11 a.m. Instructor: Scott Barber
3. A 3-hour session on VAX Utilities & Commands. To be held in Room 110 of the Science Library (ISB).
 Tuesday, November 5 : 9 a.m.-Noon Instructor: Syed Zafer
4. A 2-hour session on Job Control Language (JCL). To be held in GAB 309.
 Tuesday, November 5 : 1-3 p.m. Instructor: George Morrow
5. A 2-hour introductory session on SAS.* To be held in Room 110 of the Science Library (ISB).
 Wednesday, November 6 : 3-5 p.m. Instructor: Tim King
6. Programming with REXX in MUSIC/SP.* To be held in Room 110 of the Science Library (ISB).
 Thursday, November 7 : 4-5 p.m. Instructor: Janice Green
7. Using MUSIC/SP Utilities.* To be held in Room 110 of the Science Library (ISB).
 Friday, November 8 : 8:30-10:30 a.m. Instructor: Janice Green
8. A 2-hour introductory session on SPSS-X.* To be held in Room 110 of the Science Library (ISB).
 Friday, November 8 : 1-3 p.m. Instructor: Panu Sittiwong
9. A 3-hour session on System Programming in VAX/VMS. To be held in GAB 309, Knowledge of VMS and FORTRAN helpful.
 Friday, November 8 : 3 - 6 p.m. Instructor: Ron Brashear
10. Introduction to LISREL (Analysis of Linear Structural Relationships by Maximum Likelihood and Least Squares Methods).* To be held in GAB 309.
 Monday, November 11 : 6-8 p.m. Instructor: Bob Brookshire
11. A 2-hour introductory session on Waterloo/SCRIPT.* To be held in GAB 309.
 Wednesday, November 13 : 6-8 p.m. Instructor: Claudia Lynch
12. A 2-hour session on Advanced Waterloo/SCRIPT (Thesis and Dissertation Production).* To be held in GAB Room 309. Pre-Requisites: MUSIC/SP knowledge and Basic knowledge of Waterloo/SCRIPT.
 Thursday, November 14 : 5:30-7:30 p.m. Instructor: Panu Sittiwong

TCOM Short Courses

The following short courses will be offered at TCOM in November. They will be in the form of lectures, and you should pre-register to attend. Contact Cindy at (817) 735-2550 and she will register you for the course(s) of your choice.

Introduction to Data Communications - Tuesday, November 5, 10 a.m.-Noon MED ED 1 #548, Instructor: Scott Barber

Introduction to MUSIC/SP - Monday, November 11, 9-11 a.m., MED ED 1 #458, Instructor: Janice Green

Introduction to SPSS-X - Tuesday, November 12, 1-3 p.m., MED ED 1 #458, Instructor: Panu Sittiwong

Introduction to SAS - Wednesday, November 13, 3-5 p.m., MED ED 1 #458, Instructor: Tim King

Overview of VAX 11/780s - Tuesday, November 19, 2-5 p.m., MED ED 1 #548, Instructor: Ron Brashear

Job Processing Policy Reminder

Every semester brings with it new faculty and students and returning faculty and students who have had plenty of things to think about between semesters besides what the Computing Center job processing policies are. It is for this reason that it is probably a good idea to review some of the "biggies," as far as rules go ...

- 1) One of the most important rules is the 4 COPY RULE. That is, the maximum number of copies of a job to be printed on any Computing Center printer is 4. Exceptions to this policy must be approved by the Director of Computer Systems or his authorized representative. VIOLATIONS WILL BE REPORTED TO THE APPROPRIATE VICE PRESIDENT. This rule should be taken very seriously.
- 2) Jobs with identical job names waiting to execute will be canceled.
- 3) No more than 5 jobs can be submitted to the execution queue by the same person at one time. Additional jobs will be canceled unless special permission has been obtained and Computer Operations has been notified. Permission may be gained by contacting Academic Computing Services (ISB 119, 8-5 M-F).
- 4) Jobs can have different classes, and if you misclassify your job it may be canceled. Following is the job class schedule.

CLASS:	TIME/LINES RESTRICTIONS:	# OF TAPES:
A	3*TIME + (LINES/1000) <= 45	NONE
B	3*TIME + (LINES/1000) <= 45	ONE
C	3*TIME + (LINES/1000) <= 45	THREE
D	3*TIME + (LINES/1000) <= 45	TWO
J,K,N	3*TIME + (LINES/1000) < 45	THREE
M	3*TIME + (LINES/1000) < 45	THREE

BATCH CLASSES (TIME + LINES <= 4) (NO TAPES):

CLASS:	COMPILER:
1	PLC
2	WATFIV
3	SPITBOL
4	WATBOL
5	WATFIV-S

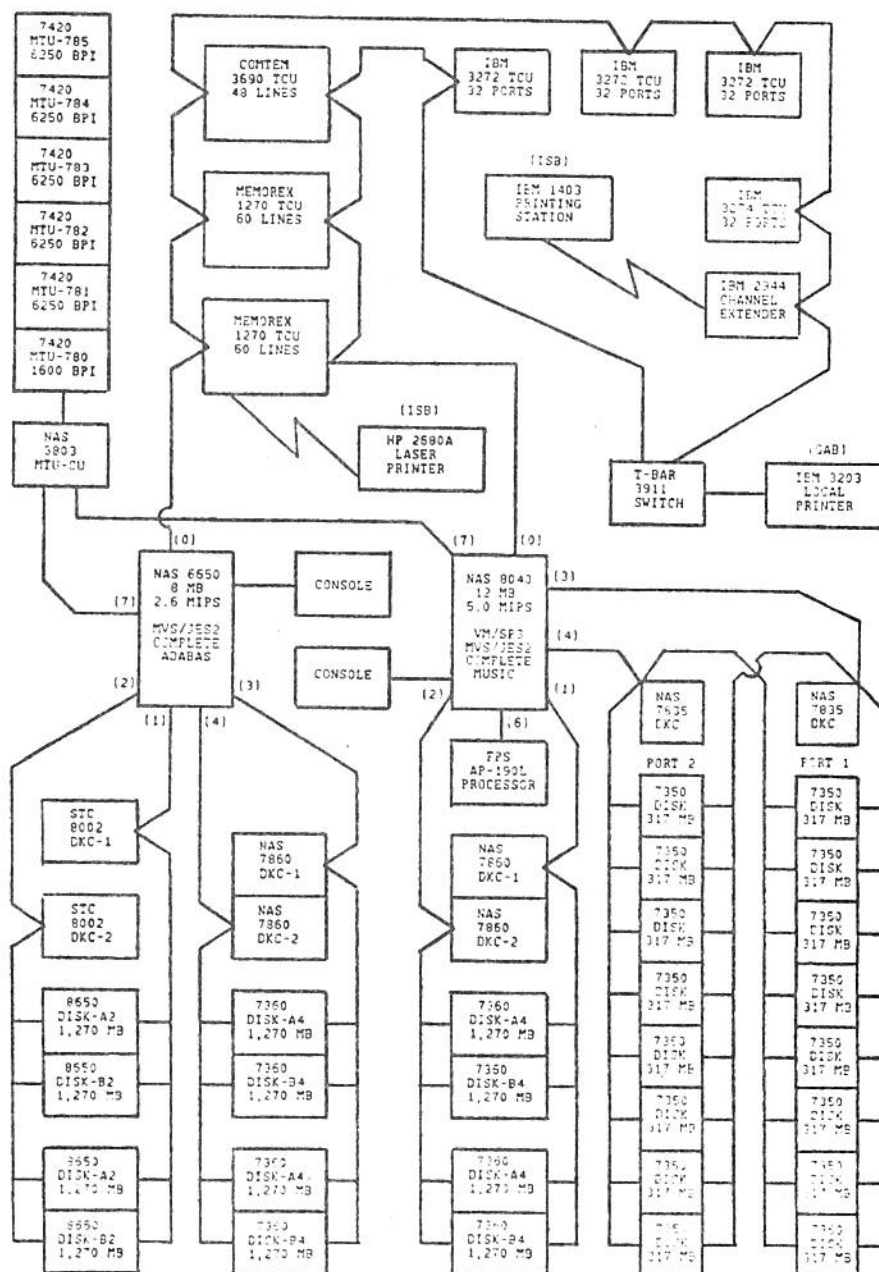
NOTE: Class J,K,L,M, or N jobs must have a special handling notice submitted to the operators via 'SURF' stating time, lines, and number of devices (tapes) required before the jobs will be processed. Enter HELP SURF while in *GO mode on MUSIC for more information.

Class L is reserved for jobs requiring over one megabyte (1024K). Permission to run such jobs must be obtained from Academic Computing Services (ISB 119, 8-5 M-F).

More information about Computing Center JOB processing policies can be obtained by entering HELP OPER from *GO mode on MUSIC.

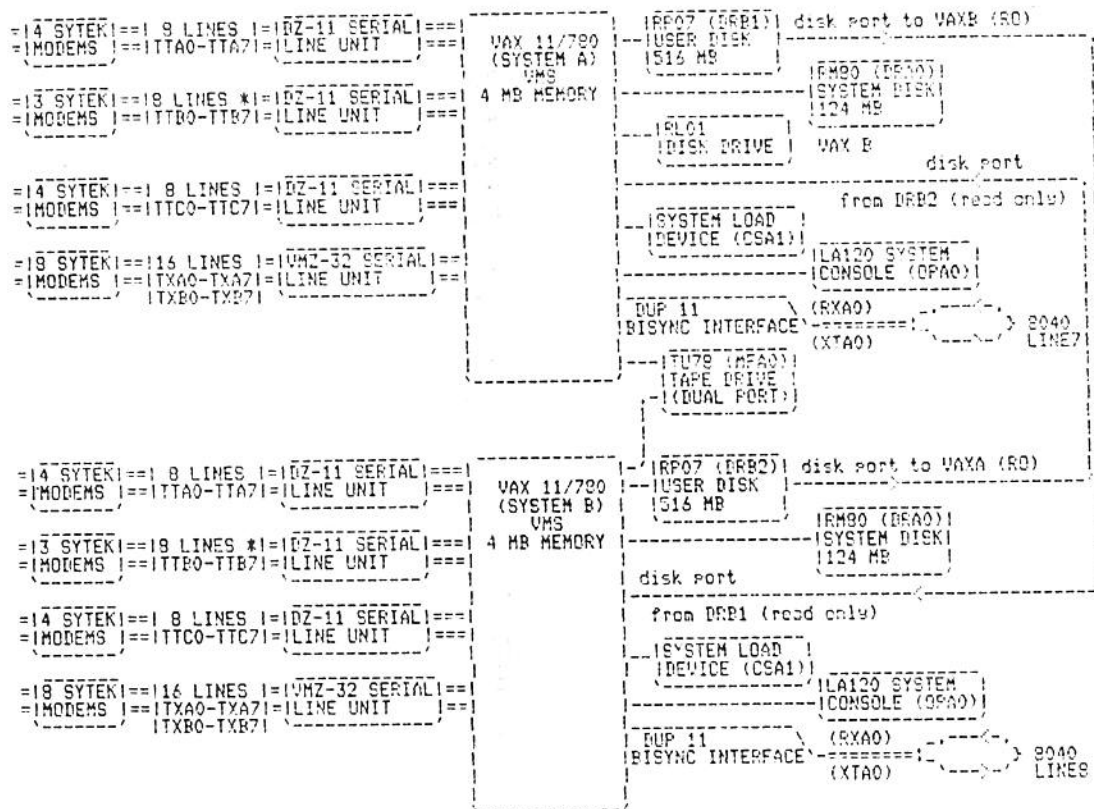
Current System Configuration (Hardware) of the NAS/8043, 6650*, and VAX 11/780 Computers

NAS/6650 AND NAS/8043 SYSTEM CONFIGURATION



**Note: Operating Systems are listed for the NAS/6650 and 8043 Computers.*

VAX 11/780 SYSTEM CONFIGURATION



* INCLUDES OPERATOR TERMINAL (TTB6) AND PRINTER (TTB7)

Sending Files From MUSIC to VAX: The TOVAX Utility

By Lee Harper, VAX Operator

If you have a file in a MUSIC save library file that you would like to send to VAX A or VAX B, there is a new utility for that purpose. In order to use this utility, you will need an MVS batch user ID code and password, and be logged on to MUSIC. While logged on to MUSIC, type the command: **TOVAX**. There will be prompts for 1) the MUSIC file you want to transfer, 2) the VAX filename you want it transferred to, 3) your MVS batch user ID code, 4) your MVS batch password, and 5) the VAX user ID code that you want to send the file to. The instructions given with the prompts are very complete, but here is some extra help just in case.

The first prompt is for the MUSIC library save file that you want to transfer to the VAX machine. The second prompt is for a fully-qualified VAX filename, consisting of the disk name, the directory name, and the filename. The disk name should be 'DRB1:' if you want to send your file to VAX A, and 'DRB2:' if you want to send your file to VAX B. The directory name is usually the name of the VAX user ID code, but can be a subdirectory if so desired. Use parentheses "(" and ")" to enclose the directory specification instead of the brackets normally used on the VAX, because the brackets do not translate too well when using the 3270 protocol converter. The third and fourth prompts are the user ID code and password you would normally use on a JCL job card for MVS. The fifth prompt is a user ID code on the VAX that the file is going to. This VAX user ID code will receive a MAIL message when the transfer of the file you are sending is complete, telling whether or not the file transfer was successful.

The last thing you should do to make the transfer complete is to log on to the VAX machine (use ID code TEST, password = TEST if you do not have a VAX user ID code) that you have sent the file to and type: TEL.RUN This will activate the process on the VAX that will take the file you sent and attempt to copy it to the directory you specified.

Note: Files with more than 9999 lines will not transfer all at one time. Divide the file into 9999 segments or less and transfer in multiple runs.

Using Waterloo/SCRIPT for Preparing Theses and Dissertations

By Panu Sittiwong, Academic Computing Services

People who use the Waterloo/SCRIPT layout SYSPUB in preparing their theses or dissertations are faced with the fact that many of the default formats provided by SCRIPT do not conform with the formats which the NTSU Graduate School requires. In order to solve this problem, I have created a new superset of SYSPUB. This superset is stored as a public file on MUSIC with the filename of **NTSU.FORM**. The contents of this file are the defined macros which generate first level headings (chapters), second level headings (sections), third level headings (subsections), fourth level headings (subsubsections), table formats, and figure formats.

In order to use the new macros, you must include the NTSU.FORM file as the first file in your print program, as illustrated below.

```
//XXXXPRNT JOB (XXXX.:05,3),YOUR NAME,PASSWORD=YYYYYY
// EXEC SCRIPT
//SYSPRINT DD SYSOUT=(A,T,N01)
//SYSIN DD *
/INC NTSU.FORM
/INC YOUR.CHAPTER.ONE
```

When including the new macros into your file, you must substitute several new commands for SYSPUB commands. The command **.chapter 'title'** will produce the first level heading (chapter). the chapter title will be printed with the word CHAPTER and chapter number in Roman numerals. The title of the chapter will be printed in uppercase letters.

The command **.ntsect** will produce the second level heading (section). The format is as follows: **.ntsection 'title'** where **title** is the title of the section. The title will be centered and printed as entered. There will be triple spaces between the last line of text and the title line of the section.

The third level heading (subsection) is generated with the command **.ntsubsect 'title'** where **title** is the title of the subsection. It will be centered, printed as entered, and underlined.

The fourth level heading (subsubsection) is produced by the command **.ntsubsub title**. The title of the subsubsection will be printed indented 5 spaces from the left margin and underlined.

Tables can be created with four commands:

```
.nttabnum name
.tabbegin
.nttable name 'title'
.tabend
```

The **.nttabnum name** command will automatically assign the table number for a particular table in a sequential manner. The **name** is a reference name.

The **.tabbegin** command signals the beginning of the contents of a table. This command must immediately follow by the command **.nttable name 'title'**. The latter will produce the table heading. The table heading will be centered with the word TABLE followed by a Roman Numeral. The title of the table will be also centered and printed as entered. There will be a double space between table number and table title. Finally, the table is ended with the command **.tabend**.

Figures are created with four commands:

```
.fignum name
.figbegin
.ntfigure name 'title'
.figend
```

The **.fignum name** command assigns the figure number for a particular figure in a sequential manner. The **name** is a reference name for that figure. The **.figbegin** command signals the beginning of a figure. It is followed by the content of the figure. Preceding the last line of content is the **.ntfigure name 'title'** command. This command will produce the title of the figure. If the title is shorter than one line, it will be centered and printed as entered. When it is longer than one line, the first line will be indented 5 spaces from the left margin. Finally, a figure is ended by the command **.figend**.

By including the NTSU.FORM file in your printer command file, you do not have to imbed SYSPUB, however, all other commands associated with SYSPUB can be used. Those commands include:

.titlepage
.para
.point begin, .point end
.footnote, footend
.appendix
.bibliography, etc.

Further information can be acquired by contacting me (Panu) at the Computing Center (565-2324).

Computer Trivia*

Below are a few fun facts you probably didn't know about the mainframe computers here at NTSU.

- The NAS/8043 (the academic computer) is comparable to an IBM/3083 Model E computer, but it requires 1/2 as much floor space because it is air cooled. The 3083 is water cooled.
- It takes over 2400 feet of cable, stored under the floor on the 5th floor of the GAB, to provide power and communications to the NAS/6650 (the administrative computer).
- It takes over 2100 feet of cable, also stored under the floor on the 5th floor of the GAB, to provide power and communications to the NAS/8043.
- MVS, one of the operating systems running on the mainframe computers, may be the world's largest program. It contains 520,000,000 characters, 13,000,000 instructions, and is stored on two 7350 disk drives.
- There are approximately 10,000 tapes (2400 foot reels written at 6250 bpi) in our tape library. If a book like a 2 1/2 inch thick encyclopedia volume holds approximately 2.5 million characters, 48 copies could be stored on one of our tapes in the tape library.

127,000,000 copies of the above mentioned encyclopedia could be stored on one of our 7350 disk drives (we are currently running out of disk space). Willis Library houses approximately 1 million volumes.

If all the equipment was removed from the disk room and the hardcopies of these encyclopedias were packed inside, it would only hold about 141,000 copies.

*Taken from "Points of Interest: Machine Room Tours GAB 560," prepared by Lynne Rutherford, Computing Center Operations Supervisor.

TI PC Training Stats

According to Nelda Evarts in Personnel, the Computing Center staff taught, and Personnel Services coordinated, 73 classes between February and July, 1985. Average class attendance was 7.84 persons for a total of 572 participants (individuals who attended more than one class counted once for each class). In all, 2,210.5 hours of instruction were logged, accounting for nearly one-third of all Personnel-recorded training hours in FY 84/85.


```

* * * * *
*               *
*   OPERATIONS   *
*               *
* * * * *

```

Disk Backup Schedules**Backup Schedule for OS/MVS**

OS/MVS disk packs (academic and administrative) are backed up daily, Tuesday through Saturday, from 4-6:30 a.m., and Sunday from Midnight to 3 a.m. A backup of all the operating systems on the NAS machines and their contents is done once every two weeks at some low activity period over a weekend.

MUSIC Backup Hours

A message will be sent to all users signed on to MUSIC approximately 10 minutes before backups are begun. It will be in the form ** MUSIC SHUT DOWN AT xxxx AM - SCHEDULED BACKUP **. To find out the backup hours while signed on to MUSIC, enter HELP HOURS. The following backup schedule is currently in effect:

Tuesday	3 a.m. (for about 3 hours)	Weekly backup
Wednesday - Saturday	4 a.m. (for about 2 hours)	Daily backup
Saturday	Midnight (for about 2 hours)	Daily backup

VAX Backup Schedule

Incremental backups of both VAX systems are performed Monday through Thursday at 4 p.m. Users do not have to log-off, but any files that are open at the time of the backup will NOT be backed up.

Full backups of both systems are done every Friday beginning at 8 a.m. These generally will take all day to complete. Again, users do not have to log-off, but any files that are open will not be backed up.

A "Stand Alone" backup of the system disk is done the third Tuesday of every month, in the afternoon, just before preventive maintenance. This procedure makes a copy of the system disk that can be used to restore its contents if the disk is completely destroyed. The system will be shut down; watch the system log-on message for specific times and dates.

NOTE: No backups are taken on the weekends. Requests for restoration of files should be made via MAIL to the username OPERATOR. Your file can only be restored if it existed before the last backup was done.

NAS/8043 and NAS/6650 Performance Statistics for September

CPU	SYSTEM	SCHEDULED OPERATING HOURS	PLANNED MAINT. HOURS	PLANNED PRODUCTION HOURS	UNPLANNED MAINT. HOURS	PRODUCTION HOURS ACHIEVED	SYSTEM UPTIME
8043	VM/SP3	720	3.25	716.75	8.53	708.22	98.8%
8043	MUSIC	720	30.03	689.97	12.96	677.01	98.1%
8043	MVS/JES2	720	3.85	716.15	10.77	705.38	98.5%
8043	COMPLETA	720	4.12	715.88	12.11	703.77	98.3%
6650	MVS/JES2	720	3.02	716.98	11.63	705.35	98.4%
6650	COMPLETEA	303	0.00	303.00	7.58	295.42	97.5%
6650	ADABASA	720	26.95	693.05	19.49	673.56	97.2%

System Uptime = (Production Hrs. Achieved)/(Planned Production Hrs.)

Production Hrs. Achieved = (Planned Production)-(Unplanned Maint.)

Scheduled Operating Hrs. = (Planned Maint.) + (Planned Production)

MUSIC Planned Maintenance Hours include 15.91 Hrs. for system backup.

ADABASA'S Planned Maintenance Hours include 23.87 Hrs. for system backup.

The NAS/8043 CPU achieved 100% uptime. The NAS/7360 DASD achieved 100% uptime.
The NAS/7350 DASD achieved 100% uptime. The NAS/6650 CPU achieved 100% uptime.
The STC 8650 DASD achieved 100% uptime.

BENCHMARKS**OCTOBER, 1985**

Lost productivity is calculated as the greatest amount of elapsed time that any one of the production systems was unavailable for scheduled operation. Lost productivity hours were contributed to by the following key causes:

NAS/8043 CPU:

CPU, Tape, and Disk Subsystems (NAS)

1. Scheduled PM on CPU and DASD Subsystems 4.12 HOURS

Miscellaneous

1. Installed MUSIC/SP Version of MUSIC 10.30
2. MUSIC/SP System Failures 5.46
3. VM/SP3 System Tuning/Improvements 0.50
4. MVS/JES2 System Tuning/Improvements 1.21
5. Equipment Power Down for Functional Testing of the HALON Fire
Detection/Suppression System 8.30
TOTAL 25.77

GRAND TOTAL FOR NAS/8043 29.89 HOURS

NAS/6650 CPU:

CPU, Tape, and Disk Subsystem (NAS)

1. Scheduled PM on CPU and DASD Subsystem 3.08
2. Replaced CIA Cards in CPU to Identify Source of BYMPX 0 Channel
Detected Errors 0.47
TOTAL 3.55 HOURS

Terminal Control System (IBM)

1. Replaced CIA Cards in both 3272 TCUs to identify source of BYMPX 0 Channel
Detected Errors 0.45 HOURS

Terminal Control System (COMTEN)

1. Swapped CIA Cards in 3690 TCU to identify source of BYMPX 0 Channel
Detected Errors 0.27 HOURS

Miscellaneous

1. MVS/JES2 System Tuning/Improvements 2.19
2. ADABASA System Tuning/Improvements 2.59
3. ADABASA System Failures 3.50
4. COMPLETA System Tuning/Improvements 3.51
5. COMPLETA System Failures 2.30
6. Equipment Power Down for functional testing of the HALON fire
Detection/Suppression System 8.40
7. Power Failure in ISB on I/O Equipment caused BYMPX Channel 0 to Fail 1.62
TOTAL 24.11 HOURS

GRAND TOTAL FOR NAS/6650 28.38 HOURS

```

* * * * *
*               *
*   TECHNICAL   *
*   SUPPORT     *
*               *
* * * * *

```

NAS/8043 Program Hit Parade

The following programs were used the most frequently on the NAS/8043 during the month of September.

TOP TEN PROGRAMS IN TERMS OF FREQUENCY OF RUNS

<u>Program</u>	<u>Description</u>	<u>Number of Runs</u>
1. IEWL	Linkage Editor	8032
2. PGM=*.DD	Compiled Program	7846
3. IKFCBL00	VS COBOL Compiler	6650
4. SCRIPT	Waterloo/SCRIPT	5841
5. IKJEFT01	Password Change	4129
6. IEBGENER	IBM Utility	3837
7. SASLPA	SAS	3552
8. PTPCH	Dataset Lister	2886
9. IEFBR14	IBM Null Utility	1509
10. IEBPTPCH	IBM List Utility	1417

TOP TEN PROGRAMS IN TERMS OF CPU SECONDS USED

<u>Program</u>	<u>Description</u>	<u>CPU Seconds</u>
1. PGM=*.DD	Compiled Program	44068
2. SASLPA	SAS	23891
3. SCRIPT	Waterloo/SCRIPT	11864
4. IKFCBL00	COBOL Compiler	9137
5. PTPCH	Dataset Lister	5884
6. IFOX00	System Assembler	4228
7. IEWL	Linkage Editor	3231
8. IKJEFT01	Password Change	2990
9. SPSS	SPSS-X	1447
10. IEBGENER	IBM Utility	882

```

* * * * *
*               *
*   V A X E N   *
*               *
* * * * *

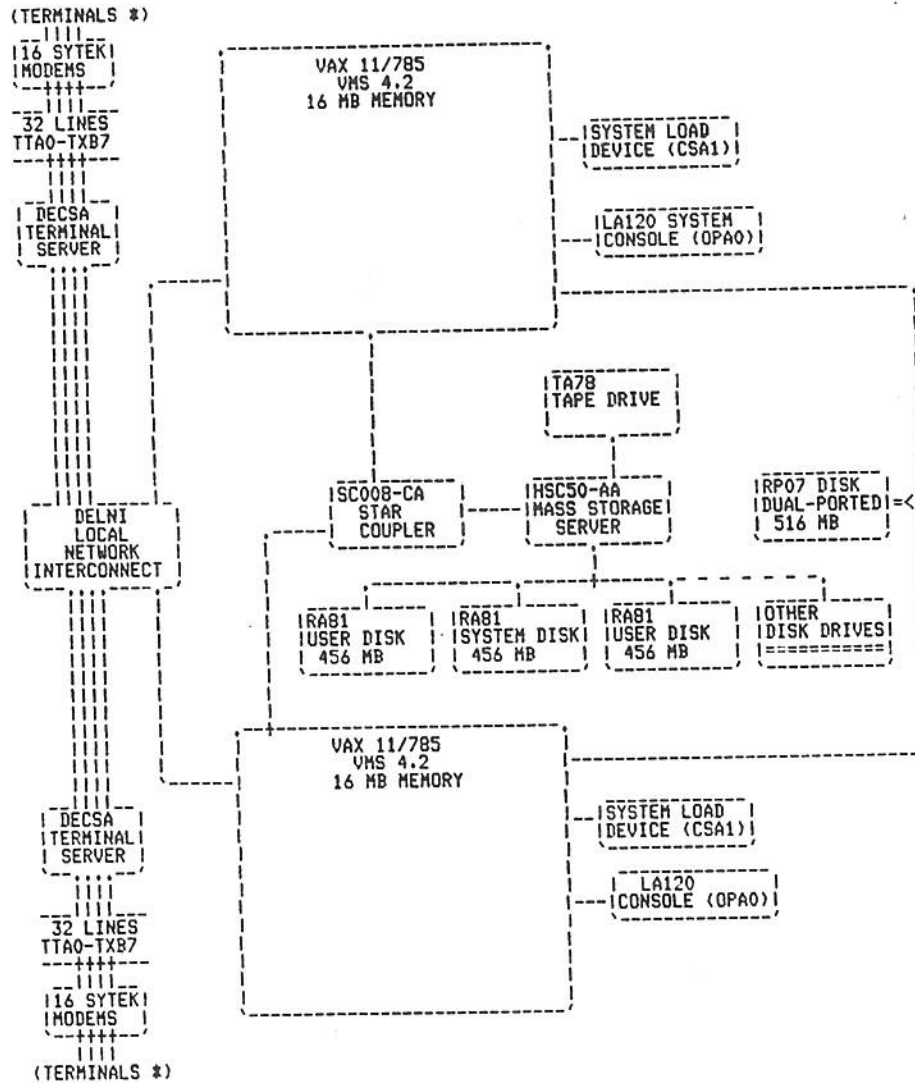
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The Proposed VAXcluster

By Lee Harper, VAX Operator

Before the end of the Fall semester, the two VAX 11/780 systems (affectionately known as VAX A and VAX B) will no longer be independent systems, but will be joined to become a VAXcluster system. A VAXcluster is a unique way to join two or more processors. It enables sharing of devices, data, and queues, while allowing one of the member systems to be down without affecting the other systems on the cluster. The average VAX user at NTSU, will not have to learn a new system or procedure for his normal routines; the same operating system (VMS 4.2) presently running VAX A and B will run the VAXcluster. However, the user will notice the advantage of having more available ports and better processor performance. To the normal user, the VAXcluster will appear to be a single VAX machine, with much more power and flexibility than two separate ones.

PROJECTED SYSTEM CONFIGURATION FOR THE VAX COMPUTERS (VAXCLUSTER)



* INCLUDES OPERATOR TERMINAL (TTB6) AND PRINTER (TTB7)

Combining two CPUs is not an original idea, but the manner in which a cluster connects them is the most sensible so far. Previous attempts to join the power of two CPUs produced either a tightly-coupled system (as found in a multiprocessor system), or a loosely-coupled system (such as two systems connected by a network). The cluster system compromises the characteristics of these two systems and therefore combines the advantages of each. See the chart at the end of this article.

Each VAX processor or HSC50 mass storage controller in a cluster is called a node. Up to 16 nodes can comprise a cluster by connecting cable, known as Computer Interconnect, to a Star Coupler. A Star Coupler is the hub of the cluster system, where all the nodes are interconnected. As an organization grows, the VAXcluster can be upgraded by plugging in more computing power or I/O resources without interrupting operation of the cluster. All disk and tape volumes, whether direct-connected to a VAX processor or through an HSC50, are accessible to all nodes.

Distribution of load on processors can be accomplished in a VAXcluster. Each user logging on to the cluster will be allocated to the least loaded processor. Cluster-wide (called generic) queues can be set up so that any jobs submitted to a batch execution queue, or to a printer queue, are spread across the cluster, keeping the processors equally loaded.

COMPARISON OF CHARACTERISTICS FOR DIFFERENTLY LINKED SYSTEMS

	Multiprocessor	VAXcluster	Network
boot/fail	together	separately	separately
security/ management domain	single	single	separate
file system	integrated	integrated	separate
growth potential	limited	powerful	unlimited
physical area	single or adjacent cabinets	single room	large area

Further information on VAXclusters may be gained by consulting the following sources, which were used as references in writing this article.

- "A Star is Born", *Digital Review* (magazine), April 1985
- "Cluster Support in Vax/VMS", *Digital Review* (magazine), April 1985
- "DEC's Mainframe Formula", *Hardcopy* (magazine), January 1985
- *Guide to Vaxclusters* (manual), Digital Equipment Corporation, 1984 (order # AA-Y513A-TE)
- *VAXcluster Software Technical Summary* (booklet), Digital Equipment Corporation

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